**WHAT IS CLAIMED IS:**

1. An optical wavelength tracking apparatus in a wavelength division multiplexed (WDM) passive optical network (PON) in which a central office (CO) having a multi-frequency light source is connected to a plurality of optical network units (ONUs) having loop-back light sources through a WDM multiplexer/demultiplexer (MUX/DEMUX) in a remote node (RN), the apparatus comprising:

a first optical power measurer for measuring a power level of a downstream WDM optical signal for the plurality of ONUs that is directed from the multi-frequency light source to the WDM MUX/DEMUX;

a second optical power measurer for measuring a power level of an upstream WDM optical signal received from the loop-back light sources of the ONUs through the WDM MUX/DEMUX; and

a control unit for controlling the WDM wavelengths of the multi-frequency light source and the WDM MUX/DEMUX to be nearly identical in order to minimize the difference between the power levels of the measured downstream and upstream WDM optical signals.

2. The optical wavelength tracking apparatus of claim 1, wherein the WDM MUX/DEMUX comprises an arrayed waveguide grating (AWG).

3. The optical wavelength tracking apparatus of claim 1, wherein the control unit controls the WDM wavelengths of a WDM DEMUX in the CO, for WDM-demultiplexing the upstream WDM optical signal to the WDM wavelengths of the

WDM MUX/DEMUX.

4. The optical wavelength tracking apparatus of claim 3, wherein the WDM DEMUX comprises an arrayed waveguide grating (AWG).

5. An optical wavelength tracking apparatus in a wavelength division multiplexed (WDM) passive optical network (PON) in which a central office (CO) having a multi-frequency light source is connected to a plurality of optical network units (ONUs) having loop-back light sources through a WDM multiplexer/demultiplexer (MUX/DEMUX) in a remote node (RN), the apparatus comprising:

a first optical divider for branching off a section of a downstream WDM optical signal for the ONUs directed from the multi-frequency light source to the WDM MUX/DEMUX;

a first optical receiver for receiving the branched optical signal from the first optical divider and outputting a voltage at the power level of the received optical signal as a reference voltage;

a second optical divider for branching off a section of an upstream WDM optical signal received from the loop-back light sources through the WDM MUX/DEMUX;

a second optical receiver for receiving the branched optical signal from the second optical divider and outputting a voltage at the power level of the received optical signal as a monitoring voltage;

a temperature control unit (TCU) mounted to the multi-frequency light source; and

a controller for controlling the WDM wavelengths of the multi-frequency light source and the WDM MUX/DEMUX to be nearly identical by adjusting the temperature of the multi-frequency light source by means of the TCU in order to minimize the difference between the reference voltage and the monitoring voltage.

6. The optical wavelength tracking apparatus of claim 5, wherein the WDM MUX/DEMUX comprises an arrayed waveguide grating (AWG).

7. The optical wavelength tracking apparatus of claim 5, further comprising an electric amplifier for amplifying the monitoring voltage applied from the second optical receiver to the controller with an amplification gain set to make the monitoring voltage equal to the reference voltage when the WDM wavelengths of the multi-frequency light source and the WDM MUX/DEMUX are nearly identical, wherein the dividing ratios of the first and second optical dividers are equal.

8. The optical wavelength tracking apparatus of claim 5, further comprising a TCU mounted to a WDM DEMUX in the CO, for WDM-demultiplexing the upstream WDM optical signal, wherein the controller adjusts the WDM wavelengths of the WDM DEMUX to be nearly identical to the WDM wavelengths of the WDM MUX/DEMUX by adjusting the temperature of the WDM DEMUX in correspondence with the temperature control of the multi-frequency light source through the TCU mounted to the WDM DEMUX.

9. The optical wavelength tracking apparatus of claim 8, wherein the WDM DEMUX comprises an arrayed waveguide grating (AWG).

10. The optical wavelength tracking apparatus of claim 8, further comprising an electric amplifier connected between the controller and the TCU mounted to the WDM DEMUX, said electric amplifier having an amplification gain set in correspondence with the difference between the wavelength characteristics of the multi-frequency light source and the WDM DEMUX with respect to temperature.

11. An optical wavelength tracking method in a wavelength division multiplexed (WDM) passive optical network (PON) in which a central office (CO) having a multi-frequency light source is connected to a plurality of optical network units (ONUs) having loop-back light sources through a WDM multiplexer/demultiplexer (MUX/DEMUX) in a remote node (RN), the method comprising the steps of:

(a) branching off a section of a downstream WDM optical signal for the ONUs directed from the multi-frequency light source to the WDM MUX/DEMUX,

(b) measuring the power level of the branched optical signal as a reference voltage, branching off a section of an upstream WDM optical signal received from the loop-back light sources through the WDM MUX/DEMUX,

(c) measuring the power level of the branched optical signal as a monitoring voltage; and

(d) controlling the WDM wavelengths of the multi-frequency light source and the WDM MUX/DEMUX to be nearly identical by adjusting the temperature of the multi-frequency light source in order to minimize the difference between the reference

voltage and the monitoring voltage.

12. The optical wavelength tracking method of claim 11, wherein the step (d)of making the WDM wavelengths nearly identical comprises the sub-steps of:

(i) periodically measuring a present difference between the reference voltage and the monitoring voltage;

(ii)maintaining the temperature of the multi-frequency light source if the present voltage difference is equal to or less than a predetermined threshold;

(iii) comparing the present voltage difference between a present voltage difference if the present voltage difference is greater than the threshold;

(iv) increasing or decreasing the temperature of the multi-frequency light source by a predetermined value in the same manner as a previous temperature change if the present voltage difference is greater than the present voltage difference; and

(v) increasing or decreasing the temperature of the multi-frequency light source by the predetermined value on the contrary to the previous temperature change if the present voltage difference is equal to or less than the present voltage difference

13. The optical wavelength tracking method of claim 12, further comprising the step of setting the value larger if the present voltage difference is relatively large and smaller if the present voltage difference is relatively small.

14. An optical wavelength tracking method in a wavelength division multiplexed (WDM) passive optical network (PON) in which a central office (CO) having a multi-frequency light source and a WDM demultiplexer (DEMUX) is connected to a plurality of optical network units (ONUs) having loop-back light sources through a WDM multiplexer/demultiplexer (MUX/DEMUX) in a remote node (RN), the method comprising the steps of:

(a) branching off a section of a downstream WDM optical signal for the ONUs directed from the multi-frequency light source to the WDM MUX/DEMUX,

(b) measuring the power level of the branched optical signal as a reference voltage,

(c) branching off a section of an upstream WDM optical signal received from the loop-back light sources through the WDM MUX/DEMUX, and measuring the power level of the branched optical signal as a monitoring voltage;

(d) controlling the WDM wavelengths of the multi-frequency light source and the WDM MUX/DEMUX to be nearly identical by adjusting the temperatures of the multi-frequency light source and the WDM DEMUX in order to minimize the difference between the reference voltage and the monitoring voltage.

15. The optical wavelength tracking method of claim 14, wherein the step (d) of making the WDM wavelengths nearly identical comprises the sub-steps of:

(i) periodically measuring a present difference between the reference voltage and the monitoring voltage;

(ii) maintaining the temperatures of the multi-frequency light source and the WDM DEMUX if the present voltage difference is equal to or less than a predetermined

threshold;

(iii) comparing the present voltage difference between a present voltage difference if the present voltage difference is greater than the threshold;

(iv) increasing or decreasing the temperatures of the multi-frequency light source and the WDM DEMUX by a predetermined value in the same manner as a previous temperature change if the present voltage difference is greater than the present voltage difference; and

(v) increasing or decreasing the temperatures of the multi-frequency light source and the WDM DEMUX by the predetermined value on the contrary to the previous temperature change if the present voltage difference is equal to or less than the present voltage difference.

16. The optical wavelength tracking method of claim 15, further comprising the step of setting the value larger if the present voltage difference is relatively large and smaller if the present voltage difference is relatively small.